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PUBLIC UTILITY GAS SYSTEMS IN NORTH ITALY

Basic information on the gas industry of North Italy, including production, consumption, and by-products.

6 December 1943

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GAS SYSTEMS
IN NORTH ITALY

I. General Considerations. In North Italy, gas is used almost exclusively for domestic purposes. Ninety-three percent of the total production of gas is used in homes, and only seven percent for industry and street lighting. Thus it is not generally used for as wide a variety of purposes as in the United States. Furthermore, the volume of gas produced in North Italy is absolutely and relatively much less than in the United States or parts of western Europe.

In 1938, over 600,000,000 cubic meters of gas were distributed through public mains to all of Italy. This is only about a hundred million cubic meters more than the total annual consumption of the city of Paris alone. Two-thirds of the total consumption, however, is concentrated in the seven compartimenti of North Italy.

There are 142 gas companies in this area, serving an approximately equal number of cities and towns. There is never more than one company per city except in the case of Imperia, where two originally independent communes with separate gas companies were subsequently merged.

The total number of consumers in this area is about 900,000. Table 1 shows the number of consumers by compartimenti, with total population figures added for comparison.

TABLE 1. NORTH ITALY: GAS CONSUMERS BY COMPARTIMENTI

Compartmento	Consumers (About 1934)	Inhabitants (1936)	Consumers Per 100 Inhabitants
Piemonte	232,991	3,506,134	6.6
Liguria	143,572	1,466,915	9.8
Lombardia	425,175	5,836,342	7.3
Veneto	63,869	4,287,806	1.5
Venezia Giulia	51,384	977,257	5.3
Venezia Tridentina	9,837	669,029	1.5
Emilia	95,586	3,339,058	2.9

As shown in Table 1, five out of six consumers live in the compartimenti of Lombardia, Piemonte, and Liguria. Furthermore, this table indicates not only that the total numbers of consumers are greatest in those compartimenti but also that a much larger percentage of the population in those three compartimenti uses gas. This is especially true of the large cities of Milano, Torino, and Genova. Thus in Torino one inhabitant in four uses gas, but in Treviso the ratio is only one in 14. For detailed comparisons between population figures and consumer figures, consult Appendix I.

The chief use of gas in private households is for cooking, though heating water is another common domestic use. The street lighting and industrial uses are of comparatively minor significance.

The number of cities using gas for street lighting probably has decreased since 1934. Genova, for instance, finally abandoned its gas lighting system in 1937, and only Bologna, of the larger cities in North Italy, appears still to be using gas for this purpose. Gas is used industrially by the FIAT works in Torino and by many printing establishments.

Note: This study is confined to gas distributed through city mains. It does not take into account the production of gas from coke ovens, blast furnaces, and oil refineries except insofar as it is purchased by city companies for public distribution. Coke oven and blast furnace gas, which amounted to 1,800,000,000 cubic meters a year during the early 1930's, are mainly used by the producing plants, themselves, or by closely connected industrial plants. In 1934 about 30,000,000 cubic meters were sold to a few large industrial customers. Of the large city utilities, only Venezia and Trieste buytheir entire supply from coke plants, while Genova gets part of its supply from a coke plant.

II. Production and Consumption

A. Raw Material

1. Coal Imports. The Italian gas industry depends almost entirely on the import of coal from abroad. Domestic raw materials, which play a very minor part, are discussed in Section 2 below.

a. Amount and origin. Table 2 shows the amounts of coal imported by Italy during the five years preceding World War II and the sources from which these supplies were obtained.

TABLE 2. ITALIAN COAL IMPORTS
(in thousands of metric tons)

Country of Origin	1934	1935	1936	1937-38*	1938-39*
Great Britain	4,679	3,189	60	2,580	2,673
Germany	4,843	7,408	6,020	8,347	6,692
France	310	63	97	75	67
Poland	1,691	1,451	950	1,635	1,823
Holland	275	154	---	80	100
Belgium	33	407	790	275	206
Russia	615	500	490	37	---
Turkey	170	380	150	83	38
Other countries	66	130	130	875	203
Totals	12,702	13,682	8,687	13,987	11,882

* The figures as above for the years 1934, 1935, and 1936 represent the calendar year; the figures for 1937/38 and 1938/39 apparently represent the business year.

It will be noted from Table 2 that the average amount of coal imported by Italy in a normal year is in the neighborhood of twelve million tons. The sharp drop in 1936 was due to the sanctions imposed on Italy as a result of the Ethiopian War.

With regard to the sources of supply, the table shows: a) that Great Britain and Germany were until 1939 the main sources of Italy's coal supply; b) that the imports from Great Britain, though almost equal to those from Germany in 1934, never regained the same importance after their almost complete eclipse during the Ethiopian War; and c) that Germany had greatly increased her exports to Italy by 1938, when she supplied almost 60 percent of Italian needs. Thus, even before the outbreak of the present war, Germany was the principal source of Italy's coal supply.

Italian coal imports since 1939 have been as follows:

	metric tons
1939	11,275,000
1940	13,692,000
1941	11,580,000
1942	7,500,000 (estimate)

The fact that coal imports were kept on a pre-war level through 1941 can mean only that, during the first two years of war in Europe, Germany made up for the loss of other sources of supply. This hypothesis is borne out by the following statistics covering the first seven months of the year 1940.

Imports from Germany	6,077,200 tons
Imports from other sources	1,679,000 tons
	7,756,200 tons

In 1942, however, judging by the sharp drop in total imports, Germany was either no longer able or no longer willing to supply as much coal as in previous years.

Since 1935 the import of coal in Italy has been in the hands of a state monopoly (Monopolio Carbone). A law of July 6, 1940 made it compulsory for all industrial establishments and plants which keep solid or liquid fuels of any kind for their own needs to submit monthly reports on the stocks held by them to the Provincial Councils of the Corporations.

b. Transportation. Before the war, most foreign coal reached Italy by sea. For data concerning the coal unloading facilities of the North Italian ports, such as Genova, Venezia, Savona, and Trieste see C.B. 1712, Italy (with possessions): Intelligence Report, October, 1942 or the Army Engineers' Preliminary Report: Strategic Engineering Study No. 60, together with I.S.T.D. studies on the individual ports as they are issued.

The exact proportion between shipments by sea and by rail is indicated by the following statistics;

Year	Thousands of Metric Tons	
	By Sea	By Land
1937-38 -	10,723	3,298
1938-39 -	10,224	1,661

A comparison of those figures with those on page shows that even Germany must have shipped the bulk of her coal deliveries to Italy by sea, since the imports from Germany alone were far above the total coal imports reaching Italy by rail.

Since the outbreak of war, Germany has been compelled to transport practically her entire shipments by rail. The most recent figures available are those for January through July 1940, when Germany transported 5,604,200 tons by rail and only 473,000 by sea.

c, The share of gas utilities. In 1934 nearly one and a half million tons of coal were imported by the gas utilities (excluding coke works). In other words, roughly one-eight of the imports of that year went into the city gas industries. Corresponding figures for subsequent years are not available. However, since it is known that the amount of gas sold by the utilities in 1938 (approximately 610,000,000 cubic meters) was considerably higher than the total amount sold in 1934 (528,000,000 cubic meters), a correspondingly larger amount of coal must have been imported.

Since 1938 the need for foreign coal has been reduced through some increase in the use of domestic coal (see below), and through restrictive measures regarding calorific value, pressure in the gas mains, and individual gas consumption (see below). The total effect of these measures cannot be estimated, but it is clear that from 1938 on less and less foreign coal was available to the gas utilities.

A law of November 1939 compelled gas plants to maintain reserve stocks equivalent to their normal consumption needs for a three-month period, this reserve to be accumulated by January 8, 1941. This law would seem to indicate a readiness on the part of the government to provide gas works with their normal requirement of raw material. However, the law modified its own requirements by saying that it was to be complied with only if sufficient supplies were made available by the coal monopoly.

2. Domestic Coal.

a. Amount of production. During the years immediately preceding the war the average annual production of Italian coal mines was in the neighborhood of two million tons, i.e. roughly one-sixth of the amount of coal imported in a normal year. The figure is even less favorable from the Italian standpoint than it appears, however, because nearly half of Italian coal production is lignite of inferior quality. Since the outbreak of war production of lignite has been increased, and (according to some sources) it reached three million tons in 1941, thus bringing the total production of Italian coal mines to four million tons.

A general indication of the location of Italian coal mines and the quality and quantity of their production is given in Table 3. (For further details see Strategic Engineering Study No. 59: Terrain Intelligence: Italy, March 1943, Sheet 9, "Mineral Resources".

b. The use of domestic coal in the gas industry. Italian coal is not suitable for use in gas plants. Its main disadvantages when compared with foreign coal are:

i) High ash content

ii) High content of combustible sulphur

iii) High content of volatile substances, hence yielding little coke

iv) Formation of non-agglomerated or very friable coke

Prior to 1938 domestic coal was apparently not used in the gas industry. During the second half of 1938 the use of 5 percent domestic coal was made compulsory and from January 1, 1939, all gas plants which distilled more than 400 tons of coal a month had to use 10 percent domestic coal.

Italian gas experts found that the only uses which could be made of domestic coal in gas plants were as follows:

i) For burning in grills of furnaces, tar distillers, etc. This method is not of much use in furnaces of the regenerative type.

ii) For distillation of lean or mixed gas or in complete gassification. The mixed gas can be

TABLE 3. ITALIAN COAL DEPOSITS

Type	Location of main deposits	Quality of Coal (Percentages are approximate) Ash	Volatile matter	Fixed carbon	Sulphur	Moisture	Estimated Reserves (metric tons)	Production, 1939 (metric tons)
Anthracite	La Thuile (West of Aosta)	25.	5.	70.	0.3-0.5	----	15,000,000	122,000
Bituminous coal	Istria	8.27	41.97	36.40	9.94	2.30*	140,000,000	1,000,000
		14.55	30.42	34.45	7.55	1.78**		
Lignite & Brown coal	Umbria							
	Toscana	7.20**	33.77	46.17	1.98	12.84	290,000,000	1,000,000#
	Lucania							
	Sardegna							

*) Sifted coal
**) Bunker coal

#) According to some reports this figure was raised to 3,000,000 by 1941.

**) These are the figures for lignite from Grosseto, Toscana. The fixed-carbon content of brown coal is much lower.

used for heating furnaces unless they are built for coke heating only (see Section II, B, 2, Equipment of plants, below). The complete gassification method is known to have been adopted in Bologna (see Appendix II).

iii. For distillation at high temperature in admixture with foreign coal. An admixture of 9 percent of Sardinian or Istrian coal has been found to cause no decrease in quantity, but marked decline in quality; the caloric content was lowered and the cost and labor of purification was doubled because of the high percentage of sulphur compounds, especially sulphuretted hydrogen.

The use of domestic coal has been found to have an unfavorable influence on the by-products recovered. Thus, the use of 10 percent of domestic coal (in admixture with foreign coal) results in only 180 kilograms of coke per ton of domestic coal employed and as much as 300 kilograms of coke powder, whereas a ton of the best coal yields 650-680 kilograms of coke. Domestic coal yields more tar than foreign coal but the tar is of poorer quality, with a large content of paraffin, which diminishes its value for distillation.

In conclusion it may be stated that even the most ardent advocates of Italian economic self-sufficiency have always admitted that the Italian gas industry cannot be made independent of foreign coal imports. To quote a spokesman of the Italian gas industry, "As long as no method is found to correct the lack of glutinary power and the excess of sulphur, the distillation of our national solid fuels, even in small percentages, would be an absurdity."

3. Natural Gas. Prior to the outbreak of World War II, natural gas was a negligible factor in the Italian city-gas picture, and it is still of distinctly minor importance as compared with coal gas. The production of metano from wells in the northern Apennines and the Po Valley is claimed to have increased very rapidly, but the most optimistic estimate available (4,000,000 cubic meters per month in March 1942, expected to increase by 100,000 cubic meters per month thereafter, giving an estimated 6,000,000 cubic meters per month in November 1943) is dwarfed by the figures for city gas consumption in North Italy alone. Furthermore by far the greater part of this production is used for motor transport or in industry, rather than as city gas.

There is plausible evidence of the use of metano for city gas supply in only one North Italian town of any size. A pipeline built by AGIP from Podenzano to Piacenza was designed not only to supply motor fuel but also to permit, by March 1940, distribution for domestic use of uncompressed natural gas in the city of Piacenza. This pipeline has been completed, although the sources which report its completion do not mention the use of the gas for city purposes. In addition, considerable progress has been made upon a project for a trunkline to carry natural gas through North Italy. In May 1943, construction had been completed or was in progress on a trunk line extending from Bologna to Milano, with feeders from Fontevivo to Parma, from Fornovo to Parma, from Salsomaggiore to Fidenza, and from Podenzano to Piacenza. In addition to the Podenzano-Piacenza feeder (mentioned previously), the Fontevivo-Parma feeder and the Piacenza-Milano segment of the trunk line were in actual operation. Extensions of the trunk line to Torino from Milano and to Venezia from Bologna were contemplated.

There is no positive evidence of the use of this natural gas to supply cities except in the case of Piacenza, and there is much evidence that the gas was intended to supply motor vehicles, the petroleum shortage being even more acute than the coal shortage.

B. Manufacture of Gas.

1. Capacity of plants. Most gasworks in North Italy are small. No general statistics regarding their capacity are available, but a fairly accurate picture of their size may be gained from a knowledge of the amount of gas sold by each plant in the last year before the outbreak of World War II (see Appendix I). Sales represent between 77 and 86 percent of the total production, the rest being partly consumed by the plant itself and partly wasted in course of distribution. No general

statement can be made on the relation between production and capacity; although many individual plants are known to have been employed to full capacity, it has been stated that unused equipment was available in Italy at the time.

Out of a total of 142 plants only 23 sold more than two million cubic meters of gas in 1938, and only 5 of these sold more than ten million. The largest plants are, in order of size, those in Milano, Torino, Genova, Bologna, and Trieste. Together they account for nearly 70 percent of gas sales in North Italy. The Trieste plant, however, serves for storage and distribution only and does not produce any gas. More than half of the total number of gasworks in northern Italy sold less than 500,000 cubic meters.

The following statistics summarize the situation:

Plants with sales below 500,000 cubic meters	74
Plants with sales between 500,000 and 1,000,000 cu. meters	22
" " " " 1,000,000 and 2,000,000 cu. meters	21
" " " " 2,000,000 and 10,000,000 cu. meters	18
" " " above 10,000,000 cubic meters	5
Plants for which figures are lacking	2
TOTAL	142

2. Equipment of plants. Most Italian gas plant equipment, especially in smaller plants, is antiquated. Much of it dates back to the period before World War I. Unable to acquire new equipment, many companies re-

sorted to remounting or reconstruction of chambers, retorts, holders, etc. A few, however, have installed new plants in recent years.

a. Manufacturing equipment. With the exception of the small town of Lissone (north of Milano), which purchases its gas supply from the neighboring town of Seregno, all the 142 towns and cities listed in Appendix I have their own facilities for manufacturing gas. However, the manufacturing plant does not in every case form part of the city gasworks, since some companies act merely as storing and distributing agents for gas manufactured in nearby coke plants. Of the larger companies those in Venezia and Trieste belong in this category (see Appendix II), and it is possible that the same applies to the companies in some of the smaller cities where coke plants are known to exist (e.g. Vado Ligure).

The most common furnace in the larger plants is the Woodall-Duckham type, with vertical chambers for continuous carbonization, though furnaces with horizontal retorts or chambers are also in use (e.g. in Padova). Most of the small plants still have old-fashioned retort furnaces. In recent years some of the larger plants, including those at Genova and Milano, have installed modern ovens with inclined chambers. Some plants, such as those in Milano, Bologna, Padova, Fiume, Udine, Como and Treviso, have ovens for complete gassification (Strache system), apparently always in addition to other types of furnaces.

Most furnaces are heated with producer gas, though others, for instance most of those in the Padova plant, are heated with coke. Coke heating has become a problem since the outbreak of war, because of the scarcity of coke. The Bologna plant has changed over to at least partial heating with gas. Most furnaces, at least in the larger plants, are of the regenerative type.

Furnaces in the larger plants yield about 400 to 500 cubic meters of gas per metric ton of coal, while those in smaller plants yield about 300 cubic meters.

There are supplementary water-gas plants in Milano, Torino, Bologna, Brescia, Trento, and probably in other cities. The Bologna gas works suspended production of water gas in 1939.

b. Gasholders. Practically all gasholders are of the standard wet type. The only dry-type holders known in the area are those recently constructed in Genova and Porto Marghera; these, however, do not belong to the municipal gasworks, but to coke plants.

So far as known, only Milano, Torino, and Genova have large gasholders, i.e. with capacities of between 50,000 and 100,000 cubic meters). Most cities have groups of small holders, with capacities of between 2,000 and 5,000 cubic meters. Even holders constructed in recent years belong in this category. Thus Verona adopted a policy of building small holders, scattered over various points on the periphery of the city, as a safeguard against air-raids. This may well be a typical case.

Only in a very few cities is the total capacity of the gasholders known. In most instances, capacity is below - in some cases considerably below - the average daily consumption of the city concerned. However, since a ratio of 3 to 4 between the capacity of the holder and the daily consumption is considered normal, this means merely that production in most hours could not be increased without adding to the existing holders.

c. Equipment for the recovery and processing of by-products. Little is known about the equipment available in the gas plants of North Italy for recovery and processing of by-products, but it is certain that few, if any, of the very small plants possess such equipment.

Before 1936, light oils were recovered only in the very large plants.

A 1936 law made recovery of benzol compulsory for all gas plants consuming a minimum of 8 tons of coal a day. It appears that this law was complied with by most or all of the plants to which it applies, and new equipment was installed (or old equipment re-installed) for the purpose.

Many of the larger and some smaller plants, including those in Bologna, Padova, and Mantova, have equipment for production of ammonium sulphate.

Presumably some of the larger plants have equipment for recovery and processing of other by-products, but no details are known. See also section D below.

Since the equipment possessed by the gas plant in Mantova in 1938 is probably typical of many small and medium-sized gas plants in North Italy, a brief description of that plant is given, as follows:

Installations were built in 1911 and include a setting of six regenerative ovens and a gasholder of 2,000 cubic meters capacity. A plant for making ammonium sulphate out of ammonia water was added in 1912. During World War I a benzol-extraction plant was added. This is substantially the present structure of the plant, although there are now at least two gasholders in Mantova.

3. Quality of gas produced. According to a general statement of 1938, the calorific value of gas distributed in city mains was at that time fixed at an average of 4,200 calories per cubic meter. To what extent individual plants deviated from this norm may be gathered from the statistics in Appendix I.

After the outbreak of World War II, various legislative measures were taken with regard to the calorific value of city gas. A law of April 4, 1940 prescribed that as from January 25 of that year, gas distributed by gas companies was to contain a minimum of 3,500 calories per cubic meter, with a latitude of 100 calories above or below that figure. This law, though phrased as a concession to the consumer, must have resulted in a considerable lowering of the quality of the gas. Its purpose obviously was to reduce the amount of foreign coal required by the gas industry. The law was suspended on October 26,1940, but reinstated on May 22, 1941. It appears, however, that as early as February 1, 1941 the calorific value had actually been reduced again from 4,100 to 3,500 calories. It is not known what further measures were taken after that time, nor is it known how much coal was saved by these measures.

Before the war not only the calorific value but also the maximum amount of impurities, and, sometimes, the maximum content of inert gases, were fixed by contract, at least in the case of private plants. The law of April 4, 1940 abolished all provisions in contracts relating to the permissible content of carbon monoxide and of inert gases Provisions relating to sulphuretted hydrogen and to ammonia remained in force.

C. Distribution Systems.

1. Pipes and other equipment. The normal material for pipes is cast iron. In recent years various plants have used steel pipes with a coating of "Eternit" or other substances, which prevent external corrosion.

No recent figures are available on the total length of pipes in individual cities. The *Annuario statistico della Città Italiane*, vol. VIII, Part 2, pp. 432-445, contains the relevant figures for 1931, but from then until the outbreak of war nearly all cities added to their network to a smaller or larger degree almost every year.

Little is known about the apparatus employed in regulating pressure in the mains. One Italian source claims that even plants of modest size and importance are provided with high-pressure feeders. The only distribution system of which some details are known is that of Milano. See Appendix II.

2. Laws regarding pressure. Although no comprehensive figures are available regarding the pressure maintained in the distribution systems of Italian gas companies

before the war, it is known that in general the pressure was considerably lower than that maintained in distribution systems in the United States. In the case of private companies the maximum and minimum pressures (variable according to the time of the day) were fixed by contract with the municipality which granted the concession.

Since 1939, various legislative measures have been introduced, which aimed at a saving of coal through a reduction of pressure in the gas mains.

A decree of September 21, 1939 prescribed that all gas companies which sold more than 500,000 cubic meters of gas in 1938 must not distribute gas at the normal and prescribed pressure for more than seven hours a day, regardless of any contract to the contrary. During the other seventeen hours of the day the pressure was to be reduced to 10 - 15 millimeters of water. The municipalities, the local commissioners for air raid precautions, and the managers of the gas works were to decide during which hours gas might be supplied at normal pressure. The law did not apply to street lighting. Hospitals and similar establishments were to receive special apparatus with which to ensure a sufficient supply during low-pressure hours.

A similar law of April 4, 1940, authorized the Minister of Corporations to determine, and if necessary vary, the daily periods during which the amount of pressure prescribed in the contracts must be maintained, and those during which it must be reduced to a minimum of 10 millimeters of water. The needs of cities with street lighting were to be taken into consideration. Hospitals were again promised special apparatus, and the same promise was made to printing presses which were absolutely dependent upon a continuous supply of gas.

This law was suspended on October 26, 1940, and reinstated on May 22, 1941, after companies had begun (on February 1, 1941) to distribute gas at uniform pressure at all hours. Finally, toward the end of 1941, most Italian cities seem to have adopted the pradtive of distributing gas only during peak hours (i.e. morning, noon, and evening), though under normal pressure. According to a newspaper report the use of gas during other hours was then forbidden, dertainly in Roma, but apparently also in other Italian cities. To what extent consumption was reduced by those measures is not known.

3. Leakage. The amount of gas wasted through leakage seems to vary somewhat from city to city. The national average in 1933 was 17.13 per cent of total production. Exact figures are known for the following three cities:

Bologna: 5 percent of production
Padova: 7 percent of production
Parma: 21 percent of production

D. By-products. Most of the information available on by-products concerns the output of all Italian gas plants, and not specifically of those in North Italy. As stated previously, however, the North Italian gas industry represents about two-thirds of total national production.

1. Coke. Although there are no statistics on the total coke production in Italian gas plants, it is known that the normal output of coke represents at least three-fifths of the amount of coal distilled. On this basis Italian coke production from gas works should have been about 900,000 tons in 1934, and about 1,000,000 tons in 1938 (see section II, A, Raw material, above, for data on coal consumption).

There are some figures available, which are distinctly lower, and which are believed to represent the amount of coke sold by the gasworks, exclusive of the amount consumed in the plants' own production processes. These figures are as follows:

Year	Amount of coke sold by gas plants	Metallurgical coke
1936	545,300	1,210,714
1937	595,153	1,693,024
1938	635,718	1,737,617
1939	851,836	2,020,195

The distribution between private and municipal gas plants is shown by the following figures:

Coke from private gasworks in 1938: 527,258 tons (83 percent)
Coke from municipal gasworks in 1938: 108,460 tons (17 percent)

Thus it appears that private plants sell a larger amount of coke than would be warranted by their share in the national production of gas (73 percent).

For information on coke as an economic factor in the gas industry, and on wartime limitations on the sale of coke, see section III, B, Economic Factors, below.

2. Light Oils. The importance of light oils to the Italian economy is indicated by a law of January 16, 1936, which makes the following provisions:

All gas plants which distil more than 8 tons of coal in 24 hours must extract from the gas a minimum of 6.5 kilograms of light oils per ton of coal. The light oil-recovery plants should preferably be of the activated carbon type, but if the scrubbing process is used, only oils obtained from distillation of coal tar are to be employed in the process. Light oils must be recovered also from the tar obtained in the process of coal distillation, unless the tar is sent to a tar distillery; for this, the process of dehydration is to be used. The entire production of crude light oils must be submitted to fractional distillation, so that purified and refined benzol, toluol, and xylol may be extracted. This last provision was repeated in a decree of August 10, 1938.

As a result of this law, light oil extraction plants were installed in all larger gas works. Production figures are available for municipal gasplants, only. These are shown in Table 4.

TABLE 4. PRODUCTION OF LIGHT OILS IN MUNICIPAL GAS WORKS
(Metric Tons)

Product	1937 Tons:	1938 Tons:	1938 (6 months) Tons:	1939 (6 months) Tons:
Crude light oils				
from gas washings	1,937	2,180	1,116	1,301
from coal tar	118	79	57	21
Total	2,055	2,259	1,173	1,322
Benzol 90 percent *	576	367	156	282
Toluol (Commercial) *	116	173	-	-

The total national output of these oils from all sources is given in Table 5 for comparison:

TABLE 5. TOTAL ITALIAN PRODUCTION OF LIGHT OILS FROM ALL SOURCES

Crude light oils				
from gas washings	20,620	22,021	11,040	13,143
from coal tar	1,049	1,047	527	338
Total	21,669	23,068	11,567	13,481
Benzol 90 percent	8,955	6,842	2,954	4,789
Toluol (commercial)	374	411	159	186

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*) From distillation of light oils

3. Other By-Products. No data on other by-products are available, but tar is, of course, produced in all plants, and many plants use the ammonia water to make ammonium sulphate.

The following statistics on the production of by-products in the gasworks in Padova may be of interest:

	1937 tons	1938 tons
Coal consumed	18,959	21,949
Coke produced	14,013	16,423
Tar produced	724	828
Benzol produced	103	162
Ammonium sulphate produced	123	92

III. Administration and Law.

A. Ownership. The gas industry of North Italy is owned partly by private companies and partly by municipalities. As shown in detail in Table 6, private companies control 78 percent of the plants and 65 percent of the sales in this area. Nearly half the total sales (46 percent) are made by the two largest plants, in Milano and Torino, both privately owned. The municipalities of Genova, Bologna, and Trieste control the three next largest plants, accounting for 23 percent of total sales. Private companies control the vast majority of the very small plants (those having annual sales of less than 2,000,000 cubic meters).

1. Private Companies. Privately-owned gas companies in Italy operate on the basis of an agreement (contratto) made between the company and the commune, granting the company the right to lay gas mains in the public streets and specifying certain conditions as to its operation, as, for example, maximum rates, minimum calorific value of the product, and maximum and minimum pressures to be maintained in distribution.

Although the majority of privately-owned plants in this area are controlled by independent companies, approximately half the total private sales are made by a single concern, the Società Generale Italiana Edison di Elettricità of Milano, whose largest plant in Milano accounts for 49 percent of total private sales. The Società Edison also controls 12 very small plants, with total

TABLE 6. OWNERSHIP OF NORTH ITALIAN GAS PLANTS, DISTRIBUTED ACCORDING TO VOLUME OF SALES IN 1938

SALES IN CUBIC METERS	PRIVATE		MUNICIPAL	
	Number	Sales (Thousands of cubic meters)	Number	Sales (Thousands of cubic meters)
Over 50,000,000	2	190,267	0	0
20,000,000 to 50,000,000	0	0	3	94,185
10,000,000 to 20,000,000	0	0	0	0
2,000,000 to 10,000,000	9	32,952	9	33,767
1,000,000 to 2,000,000	14	20,808	7	9,491
Less than 1,000,000	86	25,159	12	6,830
TOTAL	111	269,186	31	144,273

GRAND TOTAL: 142 plants; 413,459,000 cubic meters.

For the ownership of individual plants, see Appendix I.

sales in 1933 of about 8,000,000 cubic meters. Furthermore a single large holding company, the Societá Italiana per il Gas (ITALGAS), with headquarters in Torino, controls at least 24 plants (as of 1937), whose combined sales comprise at least 30 percent of total private sales in this area. The plants controlled by this company include those of Torino, Alessandria, Casale Monferrato, Novara, Cremona, and Lodi; Venezia and Mestre, taken over from the Societá Veneta Industria Gas; and Ferrara and Bassano, taken over from the Societá Triestina Elettricita e Gas. Thus the Societá Edison and ITALGAS dominate the privately-owned gas industry in this area, in volume of sales though not in the number of plants. A British concern, the Tuscan Gas Company, Ltd. (headquarters: London), controlled the small plants of San Remo, Ventimiglia, Mondovi, Saluzzo, Nizza, Savigliano, and Fossano. The Societá Colombo-Industria Gas (COLOMBOGAS-headquarters Lecco) controlled the plants in Erba, Vimercate, Feltre, Finale nell'Emilia, and Chiari.

2. Municipal Ownership. In those Italian communes where gas plants are municipally owned, production and distribution are performed by a distinct body or agency (azienda), formed by and responsible to the municipality, but largely autonomous in operation. Such an agency may furnish more than one utility, combining water and gas, electricity and gas, or all three. The agency may be set up by the municipality--under Fascist rule, by the podestá of the commune--with the approval of the by-laws of the agency by the Provincial Administrative Committee (Giunta Provinciale Amministrativa). The agency has a policy-

making body (Commissione Amministrativa), with a president. This body appoints a manager, who heads the staff.

The details of technical and administrative organization are governed by the by-laws of the particular agency. The agency may negotiate any legal contract necessary for its purposes, hire and discharge employees without interference from the municipality (except for ratification of the nomination of a manager in certain instances), and negotiate labor contracts. It is required by law to have its own budget and to keep certain accounts, separate from those of the municipality. The municipality, however, exercises authority over the budget and the by-laws of the agency and must be informed of specified matters, such as expenditures not included in the budget and contracts binding the utility beyond the limits of its fiscal period. The authority of municipal officials is not final, as the administrative commission of the agency may appeal from their recommendations to the Provincial Administrative Committee (Giunta Provinciale Amministrativa). The prefect of the province also has the legal right to require copies of the agency's records and to invalidate measures contrary to law or to the utility's bylaws or seriously injurious to the interest of the enterprise, but in practice this power is seldom used.

The agency maintains its own sinking fund and reserve. Money for new construction is borrowed from the municipality, which in turn borrows it from other sources on the security of the municipal revenues. Net income over and above interest and the legally permissible reserves is subject to the national income tax, like the income of a private company. The net income after taxes is paid by the agency to the municipality.

B. *Economic Factors.*

1. *Rates.* Italian gas companies have been obliged to operate within an increasingly rigid economic framework. Rates, in particular, have long been a subject of regulation.

It is the usual practice to compute the price paid by the consumer for gas service on a dual basis, which, in effect, takes into account the diminishing unit costs which accompany increased sales. Part of the price is a fixed charge (*nolo contatore*), which varies only according to the size of the gas-meter installed. The other part is the charge per cubic meter of gas consumed. In some cities lower rates are accorded to industries or to the commune than to private individuals.

Prior to 1936 rates were determined, in the case of private companies, according to formulae specified in the agreements by which the municipalities granted the companies the right to operate. These formulae provided for periodic variations in rates to correspond to fluctuations in the cost of coal, the volume of gas sold, and other variables.

A decree of October 5, 1936, however, froze gas rates as of that date for two years. Before the end of that period a new decree (June 16, 1938) provided for the continuation of the same rates through December 31, 1940. These are the rates detailed in Appendix I. They were modified subsequently by a series of decrees making slight changes in the rates on a nation-wide basis, as follows:

Sept. 25, 1939 - Increase of 6 centesimi per cubic meter permitted.
Apr. 4, 1940 - Further increase of 4 centesimi permitted.
July 30, 1940* - Rates frozen.
Sept. 16, 1940 - The 4 centesimi-increase rescinded.
March 12, 1941 - Provisions of 1940 price-fixing law extended for the duration of the war.
July, 1941 - Law of April 4, 1940 reinstated, thus restoring the 4 centesimi-increase.

Meanwhile, on March 6, 1941, a large number of specified companies which had reduced the calorific value of their product by dilution with inert gases rather than with combustible gases of lower calorific value were ordered by the Ministry of Corporations to reduce their rates. This was essentially designed to force the companies to change their apparatus to make dilution possible, as is evident from the fact that later in the same year provision was made for the reinstatement of the earlier rates, provided the required changes had been made. These measures incidentally clarify the economic significance of the various decrees providing for a reduction in the calorific value of gas supplied. It becomes plain that these measures, far from constituting merely

* Date of publication. Law was dated June 19, 1940

a disguised method for raising rates in a time of inflation, required companies, in the interest of remedying the national fuel shortage, to install extra equipment. The expense of this equipment was such that the slightly increased revenue per calory was not in itself adequate to induce the companies to purchase the equipment.

2. Other Sources of Income. In the financial structure of the gas industry, receipts from the sale of by-products are fully as important as those from the gas itself. Thus during the late 1930's although coal prices soared and wage scales rose at the same time that rates were frozen, the concurrent increase in coke, tar, and benzol prices helped the industry to maintain itself financially. Another saving factor was the subsidy received from the coal-importing monopoly to compensate for the increased price of coal over the 1936 figure.

In the years immediately preceding World War II, coke was by far the most important of the by-products from a financial point of view. The relative importance of benzol may well have increased since that time, however, as a result of (a) the increased use of benzol as a motor fuel, and (b) a law of April 2, 1940 limiting the sale to domestic consumers of coke produced from imported coal. The relative importance of tar may also have increased, inasmuch as coal-tar prices rose more rapidly than the prices of coal, coke, and benzol.

3. Taxes. Special taxes levied on the gas industry include a national tax of 6 centesimi per cubic meter (as of Feb.

24, 1938) and a municipal tax prescribed by national law and varying, according to the size of the municipality and other considerations, from 2 to 5 centesimi per cubic meter. A contribution is also required by the Associazione Nazionale per il Controllo della Combustione, according to the size of the plant and the amount of inspection work performed by the Associazione. Both municipal and private plants are subject to the usual national income tax. The deductions they may make from their income for amortization of capital are fixed by law as an annual percentage of the original capital invested (10 percent for gas-generating equipment, 3.5 percent for gasholders, 3 percent for cast-iron pipes, and 10 percent for meters).

C. Personnel.

1. Organizations. Employees of Italian gasworks are represented in the corporative system by two of the four national Sindacati making up the Federazione Nazionale Fascista dei Lavoratori dell'Acqua, Gas, ed Elettricità; employees of private concerns by the Sindacato Nazionale Lavoratori Dipendenti delle Aziende Private del Gas, and employees of municipal utilities by the Sindacato Nazionale Lavoratori Dipendenti dalle Aziende Municipalizzate. In some of the provincial Sindacati a further distinction is made between clerks (impiegati) and laborers (operai) of the industry.

The private employers and the municipal utilities are represented in two distinct *Federazioni*, the *Federazione Nazionale Fascista Industrie del Gas e Acquedotti* (FEDINGASAC) and the *Federazione Nazionale Fascista Aziende Industrie Municipalizzate*. Both of these are linked by common personnel with the scientific society of the industry, the *Associazione Italiana Gas e Acqua* (A.I.G.A.), which, however, also embraces related industries, such as those supplying equipment. The *Società per lo sviluppo dell' industria del gas* is a private company formed in 1924 to study problems connected with the industry.

2. *Conditions of Employment*. Separate labor contracts on a national scale are negotiated by the two branches of the gas industry,(i.e. the private companies and the municipal utilities). These, however, do not exclude local collective bargaining, as is evident from the complaint of the *Federazione Nazionale Fascista dei Lavoratori dell'Acqua,Gas, ed Elettricità* that individual private plants and municipal utilities, by freely making local contracts, upset the national equilibrium which the Fascist organizations were trying to create.

Other collective agreements regulate employees' illness and accident insurance. One such agreement, for example, negotiated October 20, 1937, to apply to the private gas industry nationally, set the total contribution for this insurance at 3 percent, half to be paid by the insured worker and half by the company. The *Istituto Nazionale di Previdenza per i Dipendenti delle Aziende*

Private del Gas is believed to be the organization which was intrusted with these funds. Full accounts of this organization's financial circumstances in 1937 and 1938 were published in the September and October-November issues of Acqua e Gas, 1939.

The gas and water industries were explicitly excluded from the application of a general interconfederal agreement, November 8, 1939, specifying pay increases permissible for overtime beyond a 40-hour week. It is not clear whether this means that pay increases for overtime work in the gas industry were not to be subject to any limitations, or whether a separate agreement was envisaged for the industry.

D. Government Supervision. As has been noted under more specific headings above, nearly every phase of the activities of gas plants in Italy is subject to governmental control, there being little difference between privately and publicly owned plants in this respect.

1. General Regulation. The basic standards for operation were established autonomously by the communes either through the agreements granting private companies the franchise, or through the actual construction of municipal plants. At the time of World War I, however, many of these stipulations proved too rigid to permit continued operation, and the practice of national modification of standards which was then inaugurated has never been wholly abandoned.

A recognized peacetime method for revising particular communal contracts exists. Within the Ministry of Corporations there is a Central Committee for Gas Utilities composed of five regular members (a State councillor, an official from the Corporate Ministry, one from the Home Ministry, and two experts from the gas industry), two members representing respectively the two parties concerned in the specific contract under question, and an advisory member from the State General Accounting Department. At the request of the parties concerned, this committee has power to revise a contract. The usual practice is for the committee to make a general decision, leaving the details of its application to a local committee of experts.

The supervisory power of the prefect over municipal utilities has been noted above. The true meaning of this power is shown by the following statement of the president of the Federazione Nazionale Fascista Aziende Industrie Municipalizzate: "In fact, the prefect's intervention is of a political rather than of an administrative character, and in practice there is no reason for him to interfere because the activities of the various utilities conform to the criteria and the principles established by the National Federation of Municipal Utilities, which is in close touch with the superior authorities as to the application of laws and provisions."

The National Corporate Council of the Water, Gas, and Electric Corporation, 7 of whose 25 members represent the gas industry, has general consultatory and regulative functions, and may regulate rates, subject to approval by the General Assembly of the National Corporate Council.

For purposes of national taxation, all plants are required to hold licenses granted by the Finance Administration.

2. Enforcement of Legislation. The detailed administration of national legislation affecting the gas industry is vested in a variety of bodies.

The Ministry of Corporations exercises considerable control. It has general supervision over the application of the law of April 4, 1940 concerning distribution, in conjunction with the Communal Technical Offices and the Prefects, and in consultation with the Ministry of Communications so far as the price provisions of the law are concerned. Together with the Associazione Nazionale per il Controllo della Combustione, it enforces the by-products law of January 16, 1936. The Ministry of Finance, in consultation with the Ministry of Corporations, determines the industries to which the national gas tax (as fixed on September 5, 1938) applies.

Detailed administration of national control over municipal gas tax rates (law of September 14, 1931) was intrusted to the Giunta Provinciale Amministrativa and the Ministry of Finance.

General supervision of the national freezing of city gas rates is vested by the law of June 16, 1938 in the Comitato Corporativo Centrale, which was empowered to make exceptions in consultation with Mussolini.

3. Control of Raw Materials. The import of coal is controlled by the Monopolio Carboni, under the Servizio Approvvigionamenti delle Ferrovie dello Stato (Supply Services of the State Railways), and monthly reports of fuel stocks on hand must be made to the Consigli Provinciali delle Corporazioni.

IV. Problems and Suggestions.

A. **Task Facing the Allied Administration.** In dealing with gas works in North Italy, an Allied administration will face a problem of greater concern to the civilian population of specific localities within the area, than to the armed forces or to industry. As has been stated, about about 900,000 consumers are dependent on the gas supply, principally for cooking purposes. Although charcoal could be used as an emergency substitute for gas -- it being customary for Italian homes to have braziers in which charcoal is burned for heating purposes --, it is noteworthy that the Italian government has seen fit to allot a considerable quantity of its precious stock of fuels to gas works. It may be emphasized, however, that the civilian population has become accustomed to severe rationing of gas, so that it would not be essential to supply raw materials sufficient for peacetime production levels at once. Plants are equipped to meet restrictions as to pressure or calorific value of gas. Furthermore, those consumers whose needs were considered by the Italian government to be most urgent (hospitals, printing presses, etc.) are presumably so equipped that their special needs may be provided for without interfering with general restrictions on consumption.

B. Procurement of Raw Materials. The problem of procuring raw materials for the gas industry may be expected to be acute, since supplies from Germany will presumably be cut off and domestic resources are inadequate. If the industry is to continue in operation, fuel from some other source will be necessary. The sources from which suitable coal was available in peacetime have been detailed above. American coal could of course also be used, although in peacetime it apparently could not bear the shipping expense.

Detailed recommendations as to future sources belong properly to a larger study of the entire fuel needs of the

Italian nation. A few considerations peculiar to the gas industry may, however, be pointed out. It would not be necessary to import peacetime quantities of coal at once. A certain amount of the low-grade domestic fuel might be used on a short-term basis. One of the primary objections to its use in the past was fundamentally economic,-- the low coke production--and could be ignored in case of necessity. Since, however, there is also danger of impairing equipment by the use of low-grade fuels, expert advice should be obtained for the specific plants in question. In some of the largest cities of the area--notably Milano--the Bologna-Milano natural-gas pipeline might be used to supply city gas rather than motor fuel, if the former shortage should be more acute than the latter.

C. Damage to the Physical Plant. How much destruction of physical plant may be expected at the outset in this area can better be gauged from actual experience in southern and central Italy than from written sources available at the time of the writing of this report. It may be useful, however, to list firms in this area which have supplied equipment to the gas industry. These are detailed as of 1937, in Appendix III. More recent issues of the Annuario Generale D'Italia and of the trade periodicals listed below in Section V, Sources of Further Information, would presumably be available in the area and could be used to bring this information up to date, and also to obtain the names of firms in adjacent areas if that seemed desirable.

British and German experience suggests that air raid damage--as distinguished from planned destruction by evacuating forces--usually affects the gas distribution system more seriously than the actual manufacturing plant. Although gasholders are easily distinguishable targets, and difficult to camouflage, it should be noted that in England only one wet-type gasholder--the variety almost universal in Italy--is known to have exploded as a result of air damage. In general, the danger of explosion arises only in the event that in some way a negative pressure is created within a main or holder so that air is mixed with gas within a confined area.

A greater danger is that of fire. Even this is not too difficult a problem, if the hit is on the side of the holder, inasmuch as the section can generally be lowered into the water, but extinguishing flames resulting from hits on the crown of the holder requires careful preparation and advance organization of repair squads. Damage to gas mains in the streets is very common, and involves not only the problem of escaping gas and hence possible fire, but also the possibility of water entering the gas mains from simultaneously destroyed water mains. In connection with these problems and with that of sabotage, it is suggested that the most recent experience with actual Italian equipment be taken into consideration. Again, recent Italian trade periodicals should be of assistance.

D. *Problems Involving Personnel*. In dealing with the gas industry, which is by nature highly localized, it probably would be feasible for the Allied administration to deal directly with local personnel, avoiding the Fascist superstructure of organization, which was not essential to the operation of the industry. In the case of municipal plants this would be part of the general problem of supervising local government; the manager of the plant would presumably be the key person to be checked for security. A large number of private plants might be brought under supervision by insuring the cooperation and reliability of ITALGAS and the Edison Company. The raw material problem ought, of course, to be closely controlled on a wider basis, possibly making some use of the Italian coal monopoly under the railway administration.

It might also be advisable to investigate the possibility of securing technical assistance from the *Associazione Italiana Gas e Acqua* (A.I.G.A.--headquarters *Via Ostiense 84, Roma*). As that body is known to have quarreled with the more distinctively Fascist *Federazioni* of the industry, it might be expected to be somewhat more friendly to Allied authorities.

V. Sources of Further Information. The information contained in this report could be supplemented by reference to certain other sources. Especially useful would be more recent issues of some of the Italian periodicals than were available at the time this report was written. The principal sources are as follows:

Acqua e Gas, monthly, published by the Associazione Italiana Gas e Acqua (A.I.G.A.), Via Ostiense 84, Roma; also serves as official bulletin of the Federazione Nazionale Fascista Industrie del Gas e Acquedotti (FEDINGASAC).

Le Industrie Municipalizzate, monthly, published by the Federazione Nazionale Fascista Aziende Industriali Municipalizzate.

Recent issues of these two periodicals should be useful for technical articles, especially pertaining to new autarchic developments and to methods for protection of plants, and for advertisements by firms supplying equipment. Statistical data is probably no longer published. Le Industrie Municipalizzate provided valuable reports on developments in particular municipal plants; Acqua e Gas was less useful for similar information concerning private plants.

La Chimica e L'Industria, monthly, published by the Società

Anonima Editrice di Chimica, Via S. Paolo 10, Milano. A regular supplement quoted prices of industrial products including coal, coke, tar, and other by-products.

Bollettino di Notizie Economiche, monthly, published by the Confederazione Fascista degli Industriali, the Associazione fra le Società Italiane per Azioni, and the Confederazione Fascista delle Aziende del Credito e dell' Assicurazione. Quotes or summarizes most laws pertaining to industry.

Annuario delle Città Italiane, published by the Istituto Nazionale di Urbanistica. Part II, *Statistica* of the 1934 volume contains statistics on gas mains.

Genova: Rivista Mensile, published by the city. The monthly supplement, *Genova Statistica*, contains statistics on the employees of the Azienda Municipale del Gas, on the consumption, price, and calorific value of gas, and on the gas tax.

Società Italiane per Azioni: Notizie Statistiche, published by the Associazione fra le Società Italiane per Azioni, Roma, contains financial data on individual large firms.

Annuario Generale Italiano, published at Roma, lists commercial addresses by city. Gas companies are listed under "Gasometie (Esere)".

Gazzetta Ufficiale and *Raccolta Ufficiale delle leggi e decreti* are the official sources for laws and decrees.

Appendix I. STATISTICAL DATA ON INDIVIDUAL GAS PLANTS IN NORTH ITALY **CONFIDENTIAL**

City	Population (commune) 1936	Ownership (private or municipal)	Consumption 1938 (thousands of cubic meters)	Consumers 1938	Calories per cubic meter	Rates			Communal tax - 1938
						Commune	Private	Industrial	
						Lire per cubic meter			
Abbiategrasso	16,018	Priv.	269	1,180	4,000	0.78	0.78	0.78	0.025
Acqui	19,023	Priv.	307	1,465	4,000	0.855	0.855	0.855	0.035
Adria	32,236	Priv.	241	711	4,284	---	0.90	---	0.03
Alassio	8,793	Priv.	377	1,661	4,037	---	0.89	---	0.042
Alba	-----	Munic.	417	1,819	4,200	0.533	0.833	---	?
Albenga	11,610	Priv.	109	380	4,100	0.80	0.90	0.75	0.05
Alessandria	83,458	Priv.	2,573	10,409	4,195	---	0.835	---	0.03
Arona	8,796	Priv.	245	1,100	4,000	---	0.80	---	---
Asti	49,933	Priv.	1,252	5,140	4,049	---	0.805	---	0.03
Badia Polesine	12,440	Priv.	99	337	4,000	0.684	0.855	---	0.042
Bassano del Grappa	23,255	Priv.	389	1,280	4,208	---	0.83	---	0.042
Baveno Stresa	3,068	Priv.	156	750	4,800	---	0.90	---	0.025

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City	Population (commune) 1936	Ownership (private or municipal)	Consumption 1938 (thousands of cubic meters)	Consumers 1938	Calories per cubic meter	Rates			Communal tax - 1938
						Commune	Private	Industrial	
						Lire per cubic meter			
Bergamo	88,722	Priv.	3,230	11,317	4,147	---	0.785	---	0.05
Biella	28,883	Priv.	963	3,424	4,300	0.89	0.89	0.89	0.03
Bologna	277,563	Munic.	25,206	56,600	4,641	0.18	0.489	---	---
Bolzano	52,787	Priv.	889	-----	-----	---	---	---	---
Borgomanero	13,097	Priv.	137	648	4,000	---	0.795	---	0.025
Bra	22,309	Munic.	229	1,190	4,300	---	0.65- 0.85	---	?
Broni-Stradella	7,045	Priv.	344	1,430	4,200	0.95	0.95	---	---
Brescia	127,653	Munic.	4,469	13,714	4,000	0.725	0.725	---	?
Busto Arsizio	42,724	Priv.	1,290	3,740	4,000	---	0.695	0.70	0.05
Casale Monferrato	39,521	Priv.	1,229	5,097	4,257	---	0.67	---	0.03
Casteggio	5,527	Priv.	60	220	4,200	0.60	0.81	0.75	0.02
Castellazzo Bormida	5,249	Priv.	52	235	4,200	---	0.935	0.85	0.02
Castelsangiovanni	9,765	Priv.	155	418	4,500	forfait	1.07	---	0.042
Cento	21,548	Priv.	108	570	4,054	---	0.95	---	0.042

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Cernobbio	5,527	Priv.	252	932	-----	0.93	0.93	0.35	---
Cernusco	3,515	Priv.	137	726	3,950	---	1.10	---	0.02
Cesena	60,072	Munic.	519	1,251	4,200	0.55	0.35- 0.72	---	?
Chiari	13,721	Priv.	134	658	4,000	---	0.798	0.6682	0.042
Chiavari	17,734	Priv.	1,477	4,500	4,200	---	0.625	0.625	0.05
Chiavazza	6,621	Priv.	---	483	4,300	0.925	0.925	0.925	0.02
Chieri	13,558	Priv.	231	1,184	4,458	0.95	1.05	0.60	0.025
Chivasso	11,450	Priv.	204	1,347	4,701	---	1.03	0.90	0.025
Codogno	11,191	Priv.	217	951	4,162	---	0.80	---	0.025
Cologna Veneta	10,330	Priv.	92	321	-----	---	0.90	0.70	0.025
Como	56,465	Priv.	4,444	13,431	4,000	0.589	0.655	0.615	0.05
Crema	24,759	Priv.	379	1,250	4,275	---	0.80	0.60	0.042
Cremona	64,791	Priv.	1,521	6,149	4,183	---	0.6925	---	0.05
Crusinallo	c.2,500*	Priv.	122	680	4,000	---	0.88	0.30	---
Cuneo	38,758	Munic.	1,009	3,974	4,500	---	0.75	---	?
Desio	13,625	Priv.	436	1,544	4,200	0.56	0.80	0.66	0.025

* Part of commune of Omegna

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City	Population (commune) 1936	Ownership (private or municipal)	Consumption 1938 (thousands of cubic meters)	Consumers 1938	Calories per cubic meter	Rates Commune	Rates Private	Rates Industrial	Communal tax - 1938
						Lire per cubic meter			
Domodossola	10,824	Priv.	271	1,226	4,000	0.855	---	---	0.025
Erba Incino	9,779	Priv.	249	1,036	4,000	---	0.955	0.7162	0.02
Este	13,836	Priv.	213	672	4,200	---	0.82	---	0.042
Faenza	47,557	Priv.	393	1,339	4,200	---	0.85	---	---
Feltre	17,099	Priv.	106	377	4,000	---	0.94	0.759	---
Ferrara	119,532	Priv.	2,007	5,640	4,024	---	0.73	---	0.05
Finale nell' Emilia	16,221	Priv.	100	298	4,000	0.57	0.96	0.732	0.025
Fiorenzuola D'Arda	9,949	Priv.	126	512	4,181	---	0.88	---	0.025
Fiume	56,249	Munic.	3,004	4,383	4,247	0.70	0.20- 0.70	---	?
Forli	65,434	Munic.	1,700	4,178	4,500	0.40	0.27- 0.75	---	?
Fossano (?)	20,636	Priv.	---	-----	-----	---	---	---	---
Gallarate	24,184	Munic.	931	2,546	4,200	0.675	0.675	---	?
Galliate	9,986	Priv.	171	837	5,000	---	1.02	0.85	0.01

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Genova	631,436	Munic.	45,320	104,777	4,492	0.20	0.425- 0.625	---	?
Genova Prá	*	Priv.	1,765	5,357	4,085	---	0.67	---	0.05
Gorizia	51,475	Munic.	1,207	2,904	4,500	---	0.735	---	?
Imola	41,535	Munic.	469	1,664	4,800	0.70	0.75	---	?
Imperia (Porto Maurizio)	28,837	Priv.	448	1,630	4,400	0.81	0.90	0.90	0.025
Imperia (Oneglia)	***	Priv.	526	1,822	4,246	---	0.90	---	0.025
Intra	13,464	Priv.	628	2,384	4,000	---	0.85	---	0.025
Isola d'Istria	9,495	Priv.	178	576	4,800	---	0.75	0.70	0.02
Ivrea	16,116	Priv.	474	1,289	4,200	0.75	0.75	0.75	0.025
La Spezia	111,523	Munic.	5,400	11,527	4,150	---	0.15- 0.545	---	?
Lecco	36,557	Priv.	1,449	5,242	4,056	---	0.78	---	0.05
Legnago	22,096	Priv.	285	851	4,233	---	0.79	---	0.025
Legnano	31,633	Priv.	1,645	4,453	4,150	---	0.73	0.72	0.05
Lendinara	15,274	Priv.	171	440	4,230	---	0.888	---	0.042
Lissone	14,911	Priv.	117**	664	4,000	---	0.90	---	0.042
Loano	5,217	Priv.	105	385	4,400	0.7225	0.85	0.80	0.042

* An industrial suburb west of Genova, incorporated in the commune of Genova.
** 1936
*** Oneglia is now part of the commune of Imperia.

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City	Population (commune) 1936	Ownership (private or municipal)	Consumption 1938 (thousands of cubic meters)	Consumers 1938	Calories per cubic meter	Rates: Commune	Rates: Private	Rates: Industrial	Communal tax - 1938
						Lire per cubic meter			
Lodi	32,212	Priv.	1,079	4,114	4,147	---	0.77	---	0.05
Luino	12,059	Priv.	343	1,340	4,200	---	0.80	---	0.025
Magenta	12,572	Priv.	238	1,062	4,030	---	0.82	0.81	0.025
Malnate	See Tradate								
Mandello del Lario	5,099	Priv.	81	539	4,000	1.00	1.00	0.90	0.02
Mantova	42,658	Munic.	1,600	7,028	4,700	0.685	0.425- 0.725	---	?
Mariano Comense	8,437	Priv.	510	1,738	4,000	---	0.93	0.752	0.020
Menaggio	2,966	Priv.	51	265	-----	---	1.30	0.70	0.02
Merano	32,882	Munic.	728	3,025	4,500	---	0.90	---	?
Mestre	44,531	Priv.	688	1,986	4,500	0.765	0.765	0.765	0.05
Milano and vicinity	1,114,111	Priv.	131,967	330,312	4,200	0.561	0.561	0.561	0.05
Mirandola	22,208	Priv.	93	414	4,118	---	1.00	---	0.025
Modena	99,601	Munic.	2,457	8,018	4,000	---	0.725	---	?
Mondovi	21,185	Priv.	322	1,878	4,087	---	0.94	---	0.042

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Montagnana (Padova)	12,356	Priv.	212	583	4,200	0.84*	0.84	0.84	?
Monza	63,368	Priv.	2,876	10,191	4,000	0.539	0.539	0.539	0.50
Mortara	11,294	Priv.	268	1,105	4,300	0.76	0.80	0.76	0.025
Murano	7,678	Priv.	217	306	4,200	---	0.88	0.70	0.05
Nizza Monferrato	8,951	Priv.	180	692	4,200	---	0.88	---	0.02
Novara	66,077	Priv.	2,150	7,772	4,058	---	0.76	---	0.05
Novi Ligure	22,417	Priv.	878	2,828	4,200	0.64	0.74	0.72	0.025
Oleggio	7,988	Priv.	91	467	4,000	---	0.80	---	?
Ostiglia	8,865	Priv.	152	704	4,287	---	0.90	---	?
Padova	143,213	Munic.	6,494	13,061	4,307	---	0.265- 0.63	---	?
Palazzolo sull' Oglio	10,352	Priv.	111	604	4,200	---	0.90	---	0.025
Parenzo	12,317	Priv.	229	420	4,600	0.633	0.633	0.633	0.042
Parma	75,768	Munic.	3,036	8,760	4,204	---	0.275- 0.725	---	?
Pavia	52,851	Munic.	2,255	8,122	4,200	---	0.75	---	?
Piacensa	70,648	Priv.	1,765	6,604	4,200	0.737	0.775	0.775	0.05
Pinerolo	23,764	Munic.	562	2,470	4,000	---	0.855	---	?
Piove di Sacco	14,851	Munic.	87	425	4,500	---	1.00	---	?

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* Commune gets discount of 5 to 20 percent

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City	Population (commune) 1936	Ownership (private or municipal)	Consumption 1938 (thousands of cubic meters)	Consumers 1938	Calories per cubic meter	Rates			Communal tax - 1938
						Commune	Private	Industrial	
						Lire per cubic meter			
Pirano	14,225	Priv.	272	882	4,800	---	0.75	---	0.042
Pola	54,515	Priv.	1,653	?	4,136*	0.775*	0.775*	0.575*	0.05*
Rapallo	14,337	Munic.	576	1,667	4,200	---	0.923	---	?
Ravenna	80,664	Munic.	914	3,111	4,257	---	0.40- 0.67	---	?
Recco	5,360	Priv.	168	369	4,400	---	1.00	---	0.02
Reggio Emilia	93,958	Priv.	1,636	5,475	3,850	0.75	0.75	0.75	0.03
Rho	19,267	Priv.	610	1,316	4,100	---	0.713	0.36	0.042
Rimini	63,871	Priv.	434	1,100	4,200	0.81	0.81	0.72	0.05
Rovereto	21,410	Priv.	280	1,147	4,296	0.747	0.89	0.60	0.042
Rovigo	39,619	Priv.	517	1,411	4,264	---	0.91	---	0.05
Rovigno d'Istria	9,723	Priv.	248	?	?	---	?	---	?
Salo	6,831	Priv.	191	760	4,000	0.80	0.90	0.60	0.025
Saluzzo	17,621	Priv.	288	1,493	4,249	---	0.88	---	0.025

* 1937 figures

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San Remo	34,543	Priv.	2,591	6,461	4,406	---	0.73	---	0.042
Santa Margherita Ligure	10,333	Priv.	414	1,306	4,207	0.51	0.95	---	0.02
Saronno	28,725	Priv.	397	1,444	4,000	---	0.86	0.86	0.03
Savigliano	18,475	Priv.	155	708	4,200	---	0.98	---	0.025
Savona	63,573	Priv.	3,555	11,052	4,176	0.561	0.66	0.66	0.05
Seregno	19,124	Munic.	566	1,324	4,800	---	0.88	---	?
Torino and vicinity	686,445	Priv.	58,300	182,324	4,351	0.66	0.66	0.66	0.05
Tortona	21,427	Priv.	452	2,107	4,065	---	0.79	---	0.025
Tradate and Malnate	7,736 6,138	Priv.	269	993	4,000	---	0.85	0.60	0.02
Trento	58,553	Priv.	756	3,147	4,200	0.80	0.80	0.80	0.05
Treviglio	19,486	Priv.	918	1,375	4,500	---	0.80	---	0.025
Treviso	56,840	Priv.	1,426	4,035	4,230	0.68	0.68	0.68	0.05
Trieste	252,437	Munic.	23,659	43,081	4,262	0.30	0.175-0.625	---	?
Trino (Vercellese)	10,304	Priv.	53*	241**	4,000**	---	1.00**	---	1.20**
Udine	70,756	Munic.	1,846	4,052	4,500	---	0.305-0.605	---	?

* 1936 figure
** 1937 figure

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City	Population (commune) 1936	Ownership (private or municipal)	Consumption 1938 (thousands of cubic meters)	Consumers 1938	Calories per cubic meter	Rates			
						Commune	Private	Industrial	Communal tax - 1938
						Lire per cubic meter			
Vado Ligure	7,897	Priv.	c. 231*	588	4,257	0.568	0.71	0.568	---
Valenza	11,417	Priv.	536	2,647	4,500	0.775	0.775	0.550	---
Varazze	11,523	Priv.	546	1,800	4,350	0.90	0.90	0.40	0.042
Varese	45,141	Priv.	1,621	5,000	4,145	0.655	0.755	0.755	0.05
Venezia	269,699	Priv.	9,520	20,932	4,500	0.765	0.765	0.765	0.05
Ventimiglia	16,762	Priv.	838	2,309	3,696	---	0.91	---	0.015
Vercelli	41,154	Munic.	1,120	3,862	3,900	0.765	0.275- 0.765	---	?
Verona	162,416	Munic.	4,394	12,874	4,000	---	0.575- 0.775	---	---
Vicenza	70,529	Munic.	2,258	6,024	4,071	---	0.725	---	?
Vigevano	37,622	Munic.	1,009	4,970	4,400	---	0.75	---	?
Villasanta	5,821	Priv.	93**	-----	-----	---	---	---	---
Vimercate	11,551	Priv.	164	577	4,000	---	0.97	0.873	0.025
Voghera	30,644	Munic.	832	3,308	4,600	---	0.70	---	?

* Estimate based on 2 months.
** 1936 figure.

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APPENDIX II. DETAILS CONCERNING SPECIFIC LARGER PLANTS

Bologna

Location of plant: 2 Viale Berti Pichat (east of main railroad station).

Location of offices: 2 Via Roma.

Equipment: A new battery of regenerative furnaces with vertical chambers of 7 tons capacity each was installed in 1936. They can be heated either with coke or with gas, and are equipped with coal grinders. A minimum of 30 tons of steam is recovered in 24 hours. A new battery of purifiers was also installed. One gasholder of 5,000 cubic meters capacity was completely rebuilt in 1935. There is also a distiller for complete gassification. After the outbreak of war this was adapted for distillation of domestic lignite.

Bologna has a tar-distilling plant and facilities for making ammonium sulphate.

Brescia

Location of plant: Probably near offices on Via Solferino, north of railroad station.

Location of offices: Via Stazione.

Equipment: There are three furnaces: two old ones, rebuilt in 1938, and a new one, built in 1937.

Ferrara.

Location of plant: The gas plant, operated by a subsidiary of ITALGAS, is located on the northeast bank of Antico Po di Volano, immediately southwest of the old town wall. In 1939 a setting of 10 continuous vertical chambers, of the Woodall-Duckham type, was either constructed or under construction at Ferrara.

Fiume

Location of plant: North of railroad engine works, in western part of city.

Equipment: The following equipment was installed in 1919:

2 generator furnaces for continuous gassification (Strache system)

5 batteries of 9 retort-furnaces, each

A new battery of furnaces with chambers was installed some time before 1937.

Genova

Location of plant: The principal gas plant is at a place usually referred to in Italian sources as "Gavetto." The recent I.S.T.D. study of Genova speaks of the main plant as located at San Sebastiano, a place located on the right bank of the Torrente Bisagno about 3 miles northeast of the port. Whether or not this is the same place, it does seem clear that the Gavette plant is located somewhere on or near the Torrente Bisagno, i.e. in the northeastern part of the city. There are gasholders located at:

a) Another point on the right bank of the Torrente Bisagno, in the northern part of the district called *Borgo Incrociati*, on Via Canevari. In 1936 this was employed as a regulating station, but it was planned to discontinue this use.

b) *Sampierdarena* (section west of the port and east of the Torrente Polcevera), immediately west of the Ansaldo boiler, Diesel, and turbine works on the east side of Torrente Polcevera: two gasholders. This was the location of the old municipal gasworks, but the plant no longer produces city gas, the entire production having been concentrated at the Gavette plant.

c) *Cornigliano* (industrial suburb west of Torrente Polcevera), in connection with the S.I.A.C. (*Società Italiana Acciaierie Cornigliano*) coke ovens adjoining the blast furnaces on the reclaimed land immediately west of the mouth of Torrente Polcevera and about half a mile upstream from the Ansaldo-Coke plant on the same side of the Torrente Polcevera.

Location of office: Via Davide Chiossone 12, in center of city.

Equipment:

At Cavetto: Prior to 1936 the equipment consisted of 6 ovens with a total of 30 vertical chambers and 16 settings comprising 160 horizontal retorts. Additions since 1935 include 4 Didier ovens, each containing 7 inclined chambers, for intermittent gassification, each chamber having a capacity of 10 tons of coal per day and producing on the average 4,032 cubic meters of gas a day at about 4,300 calories per cubic meter. New equipment for distilling and refining light oils has also been added.

At Borgo Incrociati: At least one wet-type gasholder.

At Sampierdarena: Two wet-type gasholders. Prior to 1936 16 settings with 165 horizontal retorts were in service here.

At Cornigliano: Two dry-type gasholders, of 150,000 and 50,000 cubic meters capacity, respectively, were under construction at the S.I.A.C. in 1940, and are probably the same two referred to by the I.S.T.D. study on Genova as completed. They are believed to be located between the S.I.A.C. and the Ansaldo-Coke plants. There are also wet-type holders at the Ansaldo-Coke and Ansaldo steel plants. The Ansaldo coke ovens sell gas to the municipal gas company. In 1937-1938, for example, 17 to 18 percent of the city's gas supply was purchased from Ansaldo. For the equipment of these plants, see the I.S.T.D. study on Genova.

La Spezia

Location of plant: North of Porto Mercantile, and southeast of freight station.

Equipment: Two wet-type gasholders are the only installations known.

Milano

Ownership: Società Gas & Coke Milano, owned by Società Generale Italiana Edison di Elettricità, Milano.

Location: The principal plant is located at Bovisa, an industrial suburb northwest of the city. Another plant is reported to be on the highway to Torino. Gasholders are at Bovisa and six other locations within Milano. Two installations are commonly shown on maps of the city: (1) in the northeastern section, northeast of the railway, near Via G.B. Morgagni, and (2) in the southern part of the city, northwest of Parco A. Ravizza, on both sides of Via P. Teullie. It is not known whether these are actually plants or simply distribution stations; possibly they have been converted from the former into the latter.

Equipment: In 1928 the Milano plant used principally inclined retorts, made by Stetin (Germany) and Soc. An. Forni & Impianti Industriali (Milano). A recent installation of inclined chambers at the Bovisa plant, made by Didier-Werke A.G. (Berlin-Wilmersdorf) prior to 1941, consisted of 6 settings with 42 chambers, with a combined capacity of 200,000 cubic meters per day. In 1934 the Bovisa plant alone had a capacity of 450,000 cubic meters per day. It was expected at that time that current improvements would increase the capacity to 600,000 cubic meters per day.

In 1928 a small water-gas plant was used to dilute and reduce the thermal value of the gas distributed.

Gas is distributed from the works by high-pressure mains, totalling about 50 miles in 1934, to the six gasholder stations, from which a low-pressure network totalling 500 miles distributes the gas to the consumers.

At Bovisa there are two gasholders of 80,000 cubic meters capacity each. The other gasholders had a combined capacity of 140,000 cubic meters in 1934, probably increased by at least one new 50,000 cubic meter-gasholder since that date.

Novara

Location: The gas works, operated by Italgas, is located southeast of the railway station, west of the junction of the railways from Milano and Genova.

Equipment: A Woodall-Duckham 8-chamber furnace for continuous distillation and a wet-type gasholder constructed by Ansaldo, with a capacity of 3,000 cubic meters.

Padova

Location of plant: South of main railway station, on north side of Via Trieste.

Location of offices: 5 Via Eremitani.

Equipment: In 1939 the plant had the following furnaces;

1) a battery of Kloenne furnaces with horizontal chambers
2) an auxiliary battery of horizontal retorts
   (Lachomette type)
3) an old Strache furnace for integral distillation
   (held in reserve)

A ten-year plan was inaugurated in 1938 for the construction of a new gas plant.

In 1937 a new plant for the extraction of benzol was built. Padova also has facilities for making tar and ammonium sulphate.

Piacenza

This town had a gas plant operated by the Soc. Comense per l'Industria del Gas, located on Viale Risorgimento (same as Via Milano). Piacenza is also situated on the newly-built natural gas pipeline; it was planned to use this source of supply not only for transport purposes but also for domestic use. See section II, A, 3 of this report.

Torino

Ownership: Società Italiana per il Gas (ITALGAS), which has its headquarters in Torino.

Location:

Main plant: Northeastern part of city, on southwest (right) bank of Dora Riparia River. There are two installations about 7 blocks apart.

Substation: Southwestern part of city, district of San Paolo.

Equipment: Installations constructed or under construction in

1939, by the Soc. An. Forni ed Impianti Industriali of Milano, include one battery of 30 chambers with a capacity of 125,000 cubic meters per day and two of 16 and 28 chambers respectively with a combined capacity of 163,000 cubic meters per day. All three are of the Woodall-Duckham continuous-distillation type.

Three large gasholders (1,400,000 cu. ft., 1,400,000 cu. ft., and 1,225,000 cu. ft.) in the northeastern section and three smaller ones (525,000 cu. ft., 525,000 cu. ft., and one of unknown capacity) in the southwestern section.

Torino has a light-oil processing plant, but it is not clear whether this is part of the gasworks.

Trieste

Gas for the city is produced by the coke plant of the Ilva Company at Servola (south of Trieste). The average daily production of the Ilva plant was 130,000 cubic meters in 1939, this being the maximum capacity of the purification plant.

Before the agreement with the Ilva Company was made, Trieste produced its own gas at the municipal plant in Via Broletto, at the southern outskirts of the city, east of the junction of the Pola and Parenzo railroad lines. The production equipment of this plant was dismantled in 1936, but it is possible that its gasholders are still in use. They are connected by a main with the Servola coke plant. The total capacity of gasholders in Trieste was 48,000 cubic

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Venezia

The Società Veneta Industria Gas, formerly independent but bought out by ITALGAS in 1937, listed plants in Venezia and in Mestre (an industrial suburb on the mainland northwest of Venezia). Gas is actually furnished to the city, however, according to a reliable 1938 source, by the "Vetrocoke" coke plant. This plant is located in Porto Marghera (the port of Mestre, on the mainland opposite Venezia), on the north side of North Canal (Canale Industriale Nord), and is composed of 14 buildings, totalling 1,850,000 square feet in area, with two gasholders with a total capacity of 2,450,000 cubic feet, according to an estimate based on an aerial photograph. One gasholder, built by Ansaldo about 1939, was of the dry type and had a capacity of 100,000 cubic meters. This plant is shown as "Soc. Italiana Coke" on Map 5 of the NIS Survey of Italy (S30-722), April 1943. The two "gas-works" shown in Venezia proper on the Venezia map of the same survey serve only as centers of distribution, although the larger of them probably produced gas at one time. The larger one, located immediately southwest of the Old Basin and the railroad terminal in the northwestern section of Venezia, has two gasholders (with an estimated total capacity of 500,000 cubic feet) and 18 other buildings. The other, located 2,000 feet west-northwest of Darsena Grande Basin, consists of two gasholders with an estimated combined capacity of 350,000 cubic feet, and two other buildings.

The capacity of the "Vetrocoke" plant, which was equipped in 1940 to produce 500,000 tons of coke annually, may be assumed greatly to exceed the normal consumption of the city of Venezia, but the gas is used for purposes other than domestic consumption.

Verona

Location of plant: In southeastern part of city, near Porta Vittoria and cemetery.

Equipment: In 1938 the plant still had its pre-World War I equipment, which consisted of a battery of furnaces of 16,000 cubic meters capacity per day, and gasholders of a total capacity of 9,000 cubic meters including two holders of 2,000 cubic meters capacity each. These installations were entirely inadequate. The following new installations were added with the ultimate object of raising daily production to 20,000 cubic meters:

1) a battery of condensers (these were acquired from the Trieste plant, which was dismantled)
2) a gasholder (wet type) of 5,000 cubic meters capacity
3) another gasholder of 1,000 cubic meters capacity.

Other facilities added include a chemical laboratory, and a benzol-extraction plant, which is capable of handling 24,000 cubic meters of gas in 24 hours. The expansion plan also called for the construction of a lean-gas generator and a new battery of furnaces, but it is not certain that these were actually built.

Vicenza

Equipment: A plan for renovation of the plant was adopted in 1931. Part of it was carried out by 1938, but no details are known. A benzol-extraction plant was re-installed in 1936.

APPENDIX III. NORTH ITALIAN FIRMS SUPPLYING EQUIPMENT FOR THE GAS INDUSTRY.

(Most addresses are given as of 1939)

GAS GENERATORS (GASOGENI)

Genova: Officine Liguri Costruzione Metalliche Soc. An.,
Genova-Rivarolo, via Gesare Battisti
Soc. An. SENECHAL, via F. Sivori 12
Zancani e Reale, p. Corvetto, 1
Soc. An. Autogenmetall Behringer, salita
Provvidenza 13

Malnate (Varese): Guffanti e Quartaroli, Soc. An. Gasogeni,
B.C.P. viale S. Michele del Carso

Milano: Balestra, F. via Caiazza, 33
Fischer, Carlo, via Baisello, 28
FIDUS, ripa Ticinese, 77
Scaglia, Augusto, via Sacchini, 26
Soc. An. Forni ed Impianti Industriali, via
Settembrini 7
Soc. An., Gas Dux, corso Italia 8
Igascok, Via A. Pestalozzi, 14
Soc. Gasogeni Citella, via B. Cavalieri, 6
Benedetti, via Settembrini 17

Savona: Marcantonia Dotta e Verrè, corso Cristoforo
Colombo, 3
Officine Meccaniche di Savona, Servettaz e
Basevi, corso Colombo 2

Torino: NOSTRUM, S.A.V., Via Caprera, 47
Officina C.E.A., via Ugo Foscolo, 10
Soc. An. It. Gasogeno SVELLUND, Corso Giulio
Cesare, 15

Brevetto Talmone, via Balmieri 24

Ditta Davis, via Bolfiore

GASHOLDERS (GASOMETRI)

Bergamo: SIBELLA, viale Roma

Chiavari: L.A.M.M.S. (no other address; probably sufficient)

Cuneo: Soc. An. Bongioanni, Manfredi, barriera Nizza

Genova: ANSALDO, Genova-Cornigliano

Soc. An. Bongioanni, Manfredi, Via A.G. Barili

Soc. An. SANECHAL, via F. Sivori, 12

Lancani e Reale, piazza Corvetto

Lecco (Como): Soc. An. Badoni, frazione Castello

Soc. An. "AUER", Via A. Bazzini, 23

Milano: Balestra, F. via Caiazza, 33

Impianti BAMAG, Via Enrico Toti, 4

Bongioanni, Manfredi, Via Correggio, 31

Camuzzi, Carlo e C., via Cappuccio, 14

Co. Continentale, J. Brunt, via Quadronno 41

Grande Off. della Soc. Gas e Kok, frazione Musocco

Sivy-Chamon, via Savona 95

Igascok, via A. Pestalozzi, 14

FIDUS, Ripa Ticinese

Novi Ligure: ILVA (factories there: no other address needed)

Savona: Officine Mecc. di Savona Servettaz Basevi, corso Colombo 2

Sesto S. Giovanni (Milano): Garuti Aldo e Eugenio

Torino: Brevetti Talmond, via Balmieri, 24

Ditta Davis, v. Belfiore

Soc. Torinese Industria Gas, Via XX Settembre, 14

Soc. Prodotti Siderugici Derivati, Via Caserta

Verona: Soc. An. Fonderia ed Officine Galtarossa, viale Porta Vittoria, esterna 21

METERS (CONTATORI)

Bergamo: Allason & Co.* See Torino: Branch Representative at Bergamo: no address

Agnelli Baldassare, via A. Fantoni, 10

Soc. An. Lombarda, viale Vittorio Emanuele.

Genova: Fabbrica Ligure Misuratori Gas, Soc. An., corso Giulio Cesare, 57

Vivaldi e Co., Soc. An., Mura delle Grazie

Soc. An. San Giorgio, Genova-Sestri (Diesel)

S.A.I.F.I. Via XX Settembre

Parma: F.I.A.M.A. via N. Sauro, 14

Milano: AMGAS, Via San Martino, 14

Comp. Contatori Brunt, via Quadronno, 41

Didier, Soc. An., Via Arbe, 92

Radaelli, R., Via Vittoria Colonna, 2

Sacofgas, Via Ascanio Sforza, 85

S.I.M., via Giambellino, 53

Sivy-Chamon, Soc. An., Via Savona 97

Torino: Contatori per acqua e gas, Allason, e C., Via Giacomo Collegno, 38

Bongioanni, via Monte di Pietà

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*Representatives of the more important firms are in many of the larger cities, and appear sometimes under slightly different versions of the same name.

METRON, Soc. An., Officine Piemontese, corso Marsiglia, 100

Trieste: Ilva (Servola)

OVENS (FORNI)

Genova: Forni Industriale Combustione Soc. An., L.F.I. via XX Settembre, 3

S.I.C.E.L., via E. Raggio, 3

Soc. An. Forni Stein, piazza F. Corridoni, 8

Soc. An. Forni Vignolo e Rossi, Cala Chiappella

Milano: Soc. An. Forni ed Impianti Industriale, Via Settembrini 7

Soc. per lo Sviluppo dell' Industria del Gas, via Annunziata, 4

Torino: Bertolazzi e Levi, Corso Sommeiller, 2 bis

Buscaglione, G. Via Monte di Pietà, 11

S.A.C.A.L. Corso Verona

PIPES (TUBI)

Aosta: Soc. An. Trafileria Valdostano, Corso Père Laurent, 11

Chiavari: Soc. Gasometri, Tubi Metallici Flessibili, L.A.M.E.S.

Alessandria: Bosio e C., via Piave

PROSIDEA

Soc. Comm. Prod. Siderugici e Derivati

Spalto Borgoglio

Bologna: Soc. An. Lombarda Tubi Cementi, viale Vittorio Emanuele

Soc. An. F.lli Mazzolini, Via XX Settembre

Cuneo: Tubi: Boltrami Antonio, via Statuto 1

Morino G.B. e Figli, Via XX Settembre, 1

Pulli e Corroni, Via Statuto, 4

Faenza: Nuova Coop. Braccianti etc., Via Tolosano

Fiume: Stabilimento Whitehead, Soc. An., viale Italia, 25

Cementizia Fiumana, Mareschi, v. Acquedotto, 36

Genova: ETERNIT, Soc. An., piazza Corridoni 8

F.L.M.T., Soc. An., via XX Settembre, 36

ILVA, Soc. An., via Corsica, 4

Servettaz-Basevi, Piazza Negro, 6

R.M.F., Via San Vicenzo, 1

FERRETTI, LUIGI, Soc. An., corso Dogali 49

La Spezia: Cozzani, Viale Savoia, 8

Mantova: Lozzini, Tersilio, via Vittorio da Feltre

Milano: Bongioanni, Manfredi, (Fossano), Via Correggio, 61

Soc. An. NEBIOLO, Via Bologna, 53.

Cattaneo, Soc. An., via Soresina, 14

Maffei, Eugenio, Via Valenza, 5

Soc. An. Cagliani e Marazza, via Savona 112

C.I.M.M.A., piazza Sant'Agostino, 3

Ufficio Comm. Tubi, via San Prospero, 1

Soc. Metallurgica, Italiana, v. Leopardi, 18

Modena: Corni e C. località Sacca

Soc. An. Acciaierie e Ferriere di Modena, via Carlo Goldoni, 6

Padova: Camorini, Arturo, Soc. An., via G. Cozzi, 4

Pavia: Buzzio, Pietro, viale Dalmazia, 3

Piacenza: Vitali e Casana, fuori barriera Genova

Michele, F.lli (ditta), fuori barriera Roma

Pola: Fonda, Fratelli, via Modolino, 24

Bollaz, Gaspare, via Dante, 16

San Remo: Borea, Giacomo, via Carlo Alberto, 11

Traverso, Stefano, via Pallavicini, 5

Savona: ILVA, Corso Mazzini

Torino: Bongioanni, Manfredi, Corso Valdocco, 3

Soc. Italiana Tubi Metallici Flessibili, via Cervino, 50

Soc. An. Tubi lamiere zincate, Ferdinando Manoletti, via Arsenale 29

Soc. An. Fabb. It. Tubi Metallici, corso Francia 252

Trieste: Tubi, SATIMA, riva Grumula, 2

Trento: Tubi, Soc. Cementi Armati Centrifugati, (S.C.A.C.), via Roma 26

Vercelli: Massa, Alfredo, (ditta), via Duomo

Verona: Soc. An. Ferdinando Manoletti, via XX Settembre, 75

Venezia: Baldo, Giovanni, Castello S. Gioacchino, 400

Fabb. Bottacini, A., Porto Marghera, Canale Industriale ovest.